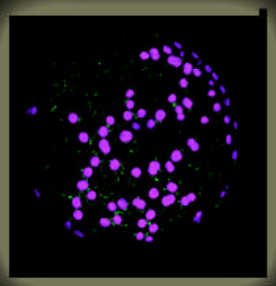
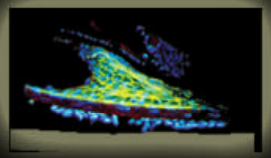
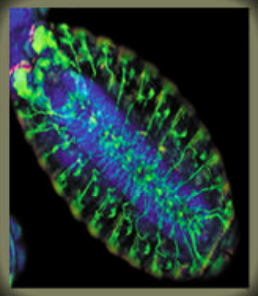
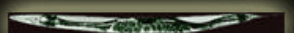
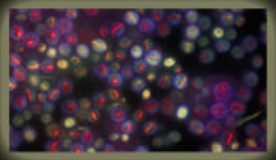




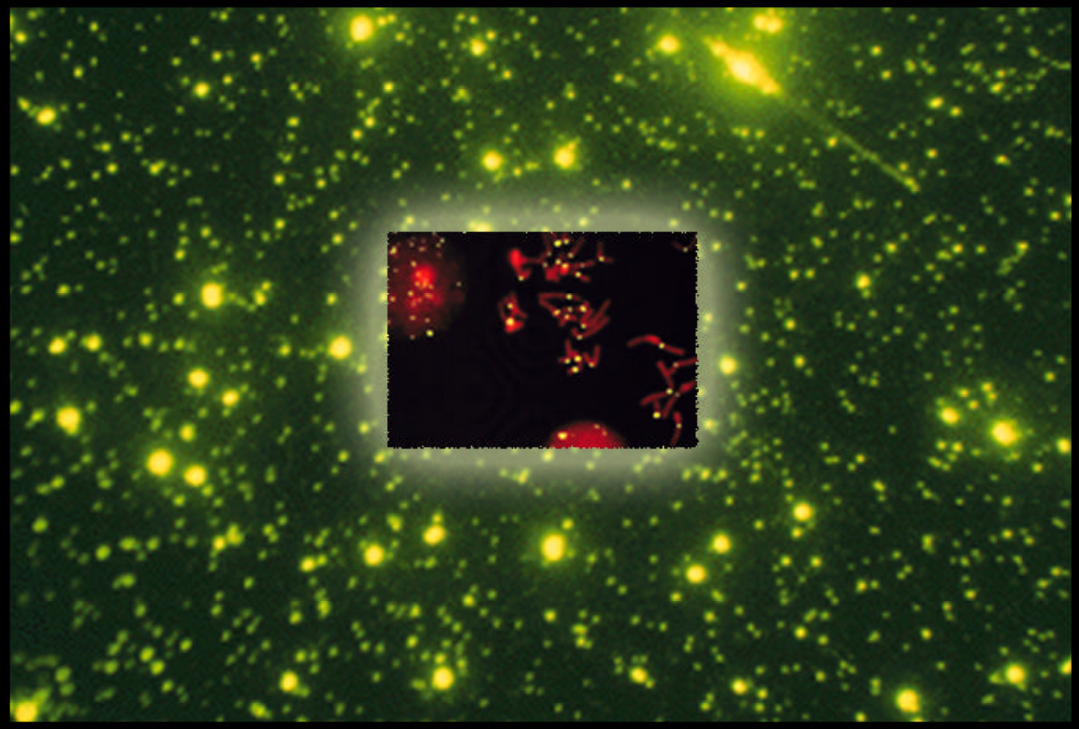






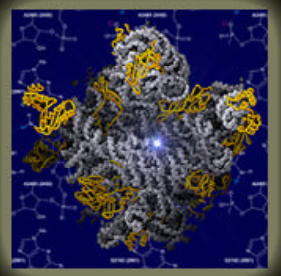
Transitions

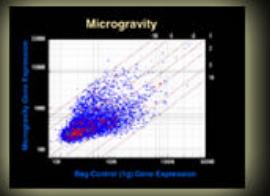
exploring life beyond earth

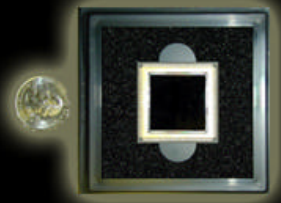


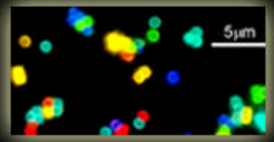
Space Biology 2002-2007

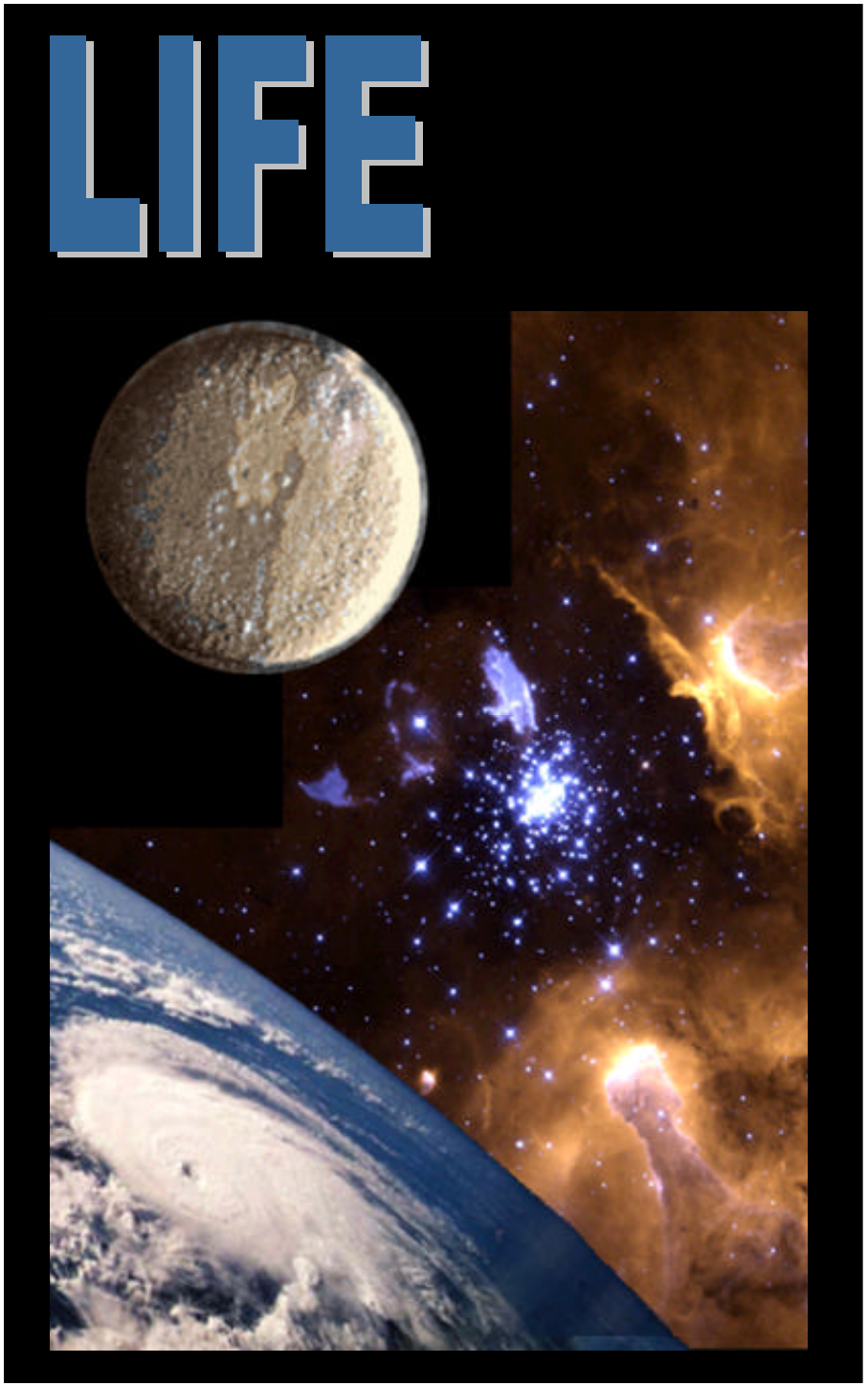
a plan for the early Space Station era







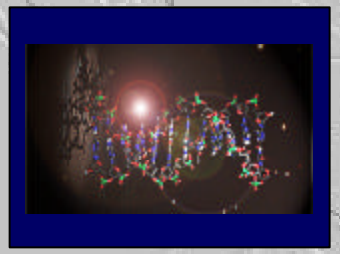
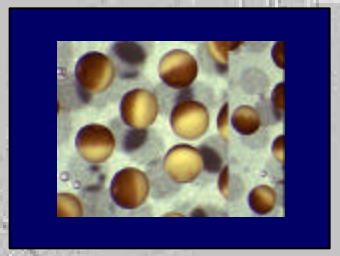




Transition to the Cosmos Space Biology

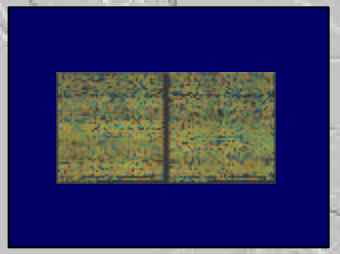
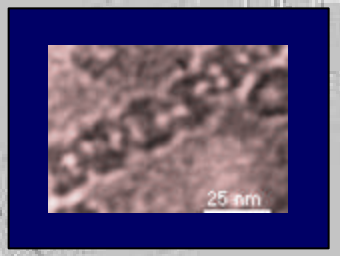
- Bring the biotech revolution to space
- On the Space Shuttle, Space Station and free-flying spacecraft
- To discover features of life that cannot be seen on Earth.
- To promote human explorations of the solar system.
- And to return benefits for humanity.

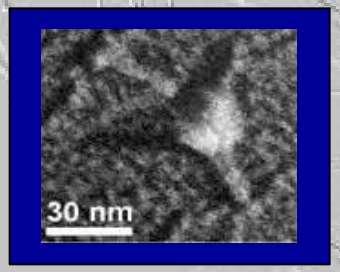
Ames Research Center

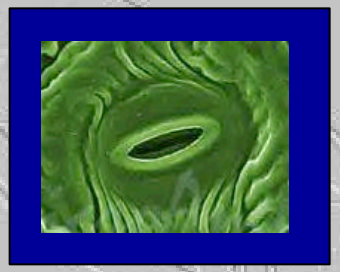



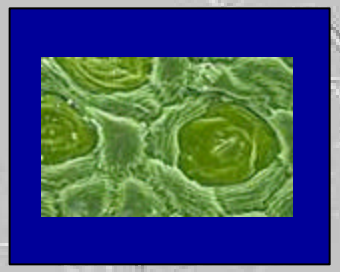
What we know

- Space is a profoundly different environment for evolution, *but reproduction of simple and complex organisms has been successful*.
- Life survives beyond Earth via unexpected and still undiscovered mechanisms, *offering a vast new realm for biological exploration*.
- We now know how to explore the most fundamental aspects of life *in the most novel evolutionary environments ever encountered to provide unique knowledge on*
  - how evolution works,
  - how cells function,
  - how to live beyond the planet of origin





Proposed

- “An integrated multidisciplinary approach
- That encompasses all levels of biological organization. . .
- And employs the full range of modern experimental approaches.”

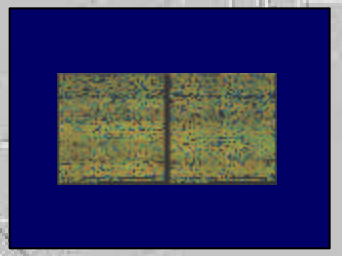
National Research Council.

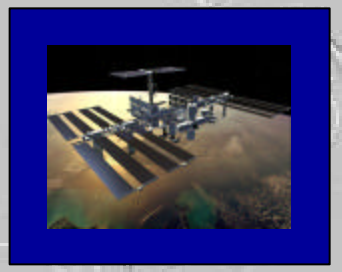
“Strategy for Space Biology and Medicine in the New Century.”

- To investigate “how organisms respond, over multiple generations, to an environment for which they have never been evolutionarily adapted.”

Nobelist Baruch Blumberg.

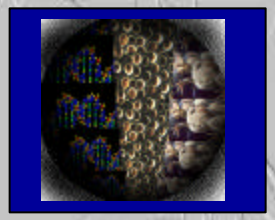
“Genomics on the International Space Station Workshop.”

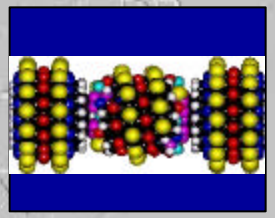


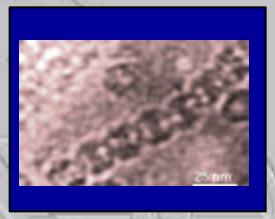


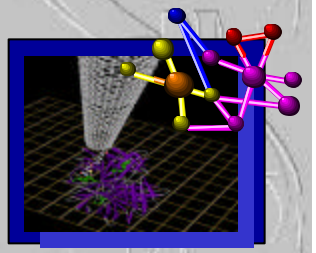
Background

- National Research Council *Strategy for Space Biology and Medicine in the New Century.*
- *Astrobiology Roadmap* developed by over 400 scientists, technologists, mission developers, societal experts
- *Genomics on the International Space Station Workshop.* Co-chaired by Nobelists Blumberg and Roberts. 1999
- *Space Biology on the Early Space Station Workshop.* Co-chaired by Nobelist Blumberg and BPRAC Chair Baldwin. 2002
- 25+ workshops on science and technology for biology since 1995
- Survey of the state of the art
- Participation in DARPA advanced technology programs.
- Interactions with industry









Focal Points

- **Begin with cells and simple systems** correlating gene response with metabolic, structural and genetic changes over multiple generations.
- **Build in scope and complexity** as spacecraft resources mature.
- **Conduct research in space** aboard Space Shuttle, International Space Station, free flyers in LEO, in deep space, and on planetary surfaces.
- **Extend research and industry involvement** via competitive and targeted partnership solicitations.
- **Encourage bio-info-nano synergies** via targeted solicitation opportunities.
- **Amplify science yield** through bioinformatics, data mining, relational databases, computational biology, scientific visualization.
- **Inspire learning** through hands-on modules that support state curriculum standards and sponsor undergraduate through postdoctoral research.
- **Promote technology transfer** via commercialization, Space Act agreements, and public/private consortia developments.